1. A polarization maintaining fiber, comprising;
   a fiber core;
   a first cladding surrounding said core;
   a coating surrounding said first cladding; wherein
   said first cladding has a cross sectional shape in the form of a distorted hexagon or a polygon with (2n –1) sides, where n>2.

2. A fiber as claimed in claim 1, wherein said core is elliptical.

3. A fiber as claimed in claim 1, wherein said core has a birefringence between 1×10^{-6} and 1×10^{-4} for the fundamental mode.

4. A fiber as claimed in claim 1, where an outer diameter of said fiber is at least 125 μm.

5. A fiber as claimed in claim 1, wherein said coating is formed of a polymer.

6. A fiber as claimed in claims 1, 2, 3, 4, or 5 wherein at least said fiber core is doped with a rare earth doping material.

7. A polarization maintaining fiber, comprising;
   a fiber core;
   a first cladding surrounding said core;
   a coating surrounding said first cladding; and
   means for minimizing polarization mode coupling in the fiber, comprising a minimum fiber outside diameter greater than 125 μm.

8. A fiber as claimed in claim 7, further comprising at least one stress producing region located within said first cladding.

9. A fiber as claimed in claim 8, wherein said at least one stress producing region includes at least one stress rod.

10. A fiber as claimed in claim 7, further comprising a second cladding surrounding said first cladding.

11. A fiber as claimed in claim 7, further comprising at least one air hole located in said first cladding.

12. A fiber as claimed in claim 11, including a plurality of said air holes arranged in a symmetric or asymmetric pattern within said first cladding.

13. A fiber as claimed in claim 8, wherein said first cladding is circular in cross section.

14. A fiber as claimed in claim 7, further comprising means for optimizing a degree of birefringence of said fiber.

15. A fiber as claimed in claim 14, wherein said degree of birefringence is between 1 x 10^{-6} and 1 x 10^{-4} .

16. A fiber as claimed in claim 7, wherein said core is non-circular, and has a major-axis to minor axis ratio of at least 1.1.

17. A fiber as claimed in claims 7, 8, 9, 10, 11, 12, 13, 14, 15 or 16, wherein at least said fiber core is doped with a rare earth element dopant.

18. A fiber as claimed in claim 7, wherein said outside diameter is at least about 150 μm.

19. A fiber as claimed in claims 7 or 18, wherein said fiber exhibits a polarization extinction ratio of at least about 100:1 after 2 meters of said fiber.

20. A polarization maintaining fiber laser, comprising;
a rare-earth doped fiber core;
a first cladding surrounding said core;
a second cladding surrounding said first cladding;

a coating surrounding said second cladding; wherein

one of said first cladding and said second cladding having a non-circular cross section.

21. A fiber laser as claimed in claim 20, wherein said core is elliptical.

22. A fiber laser as claimed in claim 20, wherein said core has a birefringence between 1×10^{-6} and 1×10^{-4} for the fundamental mode.

23. A fiber laser as claimed in claim 20, where an outer diameter of said fiber is at least 125 μm.

24. A fiber laser as claimed in claim 20, wherein said coating is formed of a polymer.

25. A fiber laser as claimed in claim 20, wherein at least said fiber core is doped with Yb, Nd, Er, Er/Yb, or Tm.

26. A polarization maintaining fiber laser, comprising;

a fiber core;

a first cladding surrounding said core;

a coating surrounding said first cladding; and

means for minimizing polarization mode coupling in the fiber laser, comprising a minimum fiber outside diameter of greater than 125 μm.

27. A fiber laser as claimed in claim 26, further comprising at least one stress producing region located within said first cladding.

28. A fiber laser as claimed in claim 27, wherein said at least one stress producing region includes at least one stress rod.

29. A fiber laser as claimed in claim 26, further comprising a second cladding surrounding said first cladding.

30. A fiber laser as claimed in claim 26, further comprising at least one air hole located in said first cladding.

31. A fiber laser as claimed in claim 30, including a plurality of said air holes arranged in a symmetric or asymmetric pattern within said first cladding.

32. A fiber laser as claimed in claim 27, wherein said first cladding is circular in cross section.

33. A fiber laser as claimed in claim 26, further comprising means for optimizing a degree of birefringence of said fiber laser.

34. A fiber laser as claimed in claim 33, wherein said degree of birefringence is between 1×10^{-6} and 1×10^{-4} .

35. A fiber laser as claimed in claim 26, wherein said core is non-circular, and has a major-axis to minor axis ratio of at least 1.1.

36. A fiber laser as claimed in claims 26, wherein at least said fiber laser core is doped with Yb.

37. A fiber laser as claimed in claim 26, wherein said outside diameter is at least about 150 μm.

38. A fiber laser as claimed in claims 26 or 37, wherein said fiber laser exhibits a polarization extinction ratio of at least about 100:1 after 2 meters of said fiber laser.

39. A fiber laser as claimed in claims 20 or 26, further including means for modelocking said fiber laser.

40. A fiber laser as claimed in claim 39, wherein said modelocking means comprises a saturable absorber.

41. A fiber laser as claimed in claim 40, wherein said fiber core supports multimodes.

42. A fiber laser as claimed in claim 41, wherein said saturable absorber has a lifetime shorter than a single-pass group delay between the fundamental and the next higher order mode in the fiber.

43. A fiber laser as claimed in claim 26, wherein said fiber laser includes at least two sections of highly birefringent fiber, and a single pass group delay between polarization eigenmodes in each section is larger than a generated laser pulse width.

44. A fiber laser as claimed in claim 20 or 26, wherein said laser is end pumped.

45. A fiber laser as claimed in claims 20 or 26, wherein said fiber laser is side pumped.

46. A fiber laser as claimed in claims 20 or 26, wherein said fiber laser includes dispersion compensation, including at least one of a grating, prism, grism or in-fiber grating within the laser cavity.

47. A fiber laser as claimed in claims 20 or 26, wherein said fiber laser comprises positive dispersion fiber, and a filter having a bandwidth less than a gain bandwidth of the fiber laser, thereby enabling said fiber laser to output parabolic pulses.

48. A fiber laser as claimed in claim 47, further including a saturable absorber having a lifetime of less than 5 times a maximum width of said output pulses.

49. A fiber laser as claimed in claim 47, further including a saturable absorber having a lifetime of less than a maximum width of said output pulses.

50. A fiber as claimed in claims 1 or 7, wherein said fiber diameter is greater than 150 um.

51. A fiber as claimed in claim 1 or 7, wherein said coating is a multi-layer coating including an inner layer of a lower Young's modulus, and an outer layer of a higher Young's modulus.

52. A fiber laser as claimed in claims 20 or 26, further including a saturable absorber having a lifetime of less than 5 times a maximum width of the laser output pulses.

53. A fiber laser as claimed in claims 20 or 26, wherein said fiber diameter is greater than 125 um.

54. A fiber laser as claimed in claims 20 or 26, wherein said coating is a multi-layer coating including an inner layer of a lower Young's modulus, and an outer layer of a higher Young's modulus.

55. A fiber laser as claimed in claims 20 or 26, further including at least one intra-cavity polarization selective element.

56. A passively modelocked fiber laser, comprising:
a fiber of high birefringence,
an intra-cavity polarization selective element,
a saturable absorber with a carrier life time shorter than a single-pass group delay between the two polarization axes of the fiber, and
an optical pump source.

57. A passively modelocked fiber laser, comprising:
a rare-earth-doped fiber that supports more than one transverse mode at the operating wavelength,
an intra-cavity polarization selective element, and
a saturable absorber with a carrier life time shorter than a single-pass group delay between the fundamental and the next higher-order mode of the fiber.

58. A passively modelocked fiber laser, comprising:
a rare-earth-doped gain fiber,
an intra-cavity optical bandpass filter with a bandwidth of less than the

bandwidth of the gain fiber,

said laser thereby producing an optical output in the form of short optical pulses with an optical bandwidth that exceeds the bandwith of the bandpass filter.

59. A polarization maintaining fiber, comprising;

a fiber core;

a first cladding surrounding said core;

a second cladding surrounding said first cladding;

a coating surrounding said second cladding; wherein

said first cladding and has a circular cross section and

said second cladding has a non-circular cross section.

60. A fiber as claimed in claim 6, where the rare-earth-doping material is Nd, Yb, Er, Er/Yb, or Tm

61. A fiber amplifier as claimed in claim 47, further including dispersion compensation means in the laser cavity.

62. A fiber amplifier as claimed in claim 47, further including in-cavity dispersion compensation means for compensating about one half of said positive dispersion.

63. A fiber amplifier as claimed in claim 51, wherein said inner coating is based on a silicone material and the outer coating is based on an acrylate material

64. A polarization maintaining fiber, comprising;

a fiber core;

a first cladding surrounding said core;

a second cladding surrounding said first cladding;

a coating surrounding said second cladding; wherein

one of said first cladding and said second cladding having a non-circular cross section.

65. A fiber as claimed in claims 1 or 64, further including non-circular stress producing regions within the fiber.

66. A fiber as claimed in claims 1 or 64, further including circular stress producing regions within the fiber.

67. A fiber as claimed in claim 64, further including stress producing regions within the fiber, and wherein said non-circular cross section comprises a distorted hexagon or a polygon with (2n –1) sides, where n>2.

68. A fiber as claimed in claims 64, 65, 66 or 67 wherein at least said fiber core is doped with a rare earth doping material.

69. An optical fiber, comprising:

a fiber core doped to provide optical gain;

a first cladding surrounding said core, having an index of refraction lower than said core, and having an outer perimeter in the form of a non-diametrically-symmetric polygon, and

a second cladding surrounding said first cladding and having an index of refraction lower than said first cladding.

70. An optical fiber as defined in Claim 69, wherein said non-diametrically-symmetric polygon comprises a pentagon.

71. An optical fiber as defined in Claim 69, wherein said non-diametrically-symmetric polygon comprises a heptagon.

72. An optical fiber as defined in Claim 69, wherein said non-diametrically-symmetric polygon comprises a non-equilateral polygon.

73. An optical fiber as defined in Claim 69, wherein said non-diametrically-symmetric polygon comprises a polygon which is equilateral except for a single shortened side..

74. An optical fiber as defined in Claim 69, wherein said first cladding includes stress-producing regions.

75. An optical fiber as defined in Claim 74, wherein said stress-producing regions are circular.

76. An optical fiber as defined in Claim 74, wherein said stress-producing regions are non-circular.

77. A polarization maintaining fiber, comprising;
a fiber core;
a first cladding surrounding said core;
a coating surrounding said first cladding; and
means for minimizing polarization mode dispersion in the fiber, comprising a minimum fiber outside diameter greater than 125 μm.

78. A polarization maintaining fiber, comprising;
a fiber core;
a first cladding surrounding said core;
a second cladding surrounding said first cladding;
a coating surrounding said second cladding; wherein
one of said first cladding and said second cladding having a non-diametrically-symmetric polygonal cross section.

79. A fiber as claimed in claims 69, 77 or 78, wherein said core is elliptical.

80. A fiber as claimed in claims 69, 77 or 78, wherein said core has a birefringence between 1×10^{-6} and 1×10^{-4} for the fundamental mode.

81. A fiber as claimed in claims 69 or 78, where an outer diameter of said fiber is at least 125 μm.

82. A fiber as claimed in claims 77 or 78, wherein said coating is formed of a polymer.

83. A fiber as claimed in claims 77 or 78 wherein at least said fiber core is doped with a rare earth doping material.